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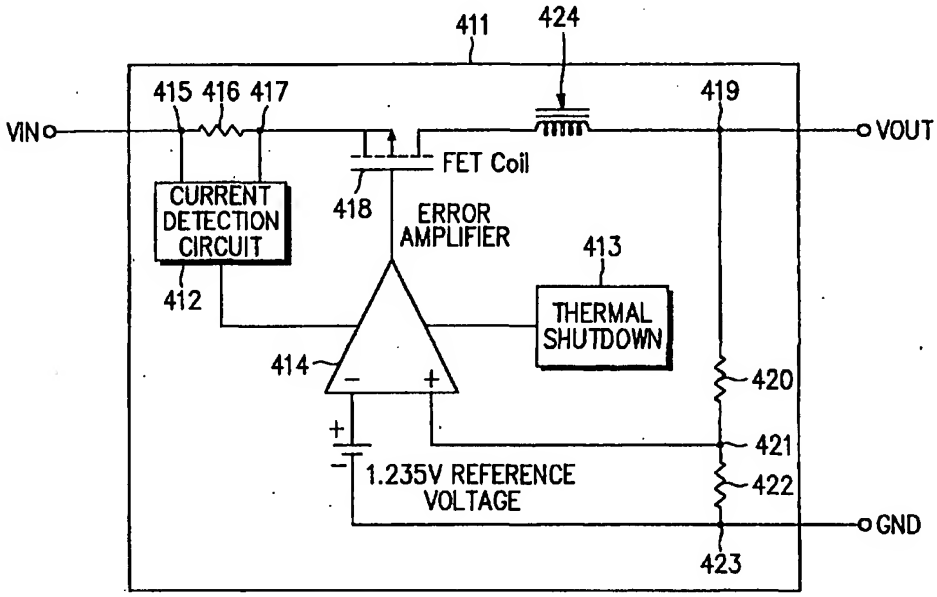
(54) Title: MOBILE PHONE CHARGER USING A USB



(57) Abstract: A battery charger for a mobile phone is disclosed. The charger has a first connector connected to a Universal Serial Bus (USB) port of various peripheral devices provided with the USB port, a second connector connected to a data communication port of the mobile phone, and a voltage conversion module for converting an input voltage from the first connector to a predetermined voltage level and then supplying the converted voltage through the second connector. A battery of the mobile phone is charged by the output voltage from the second connector.

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MOBILE PHONE CHARGER USING A USB

TECHNICAL FIELD

The present invention relates generally to a charger for charging a PCS, a hand-held phone, an IMT2000 terminal, etc, (hereinafter referred to as a mobile communication terminal), and in particular, to a charger for charging a mobile communication terminal using a USB (Universal Serial Bus) port of a device such as a computer.

BACKGROUND ART

Mobile phones such as a PCS, a hand-held phone, and the like are increasingly used all over the world. In the domestic mobile communication field, the number of mobile phone subscribers rapidly increases beyond the number of wired subscribers and the percentage of mobile phone customers of a total population is 50% or above.

The increasing geographical mobility of mobile phone subscribers makes mobile phone more attractive because they allow calls at any place. Accordingly, the number of mobile phone subscribers is increasing and use of mobile communication equipment will be more commonplace.

However, a great shortcoming of a mobile phone is the limited lifetime of its battery. The mobile phone must be charged periodically in order to continue its use. In the current developmental state of mobile phone battery technology, the charging time of the battery is limited, which causes user inconvenience.

Conventional mobile phone charging can be considered in two ways: a charger exclusively used for a mobile phone and charging the mobile phone using a cigar jack in a vehicle.

A mobile phone manufacturer provides a charger for the exclusive use of a mobile phone when it is purchased. The exclusive charger is bulky, heavy, and difficult to carry. Therefore, this kind of charger is usually left behind at home or in the office. If the battery of the mobile phone runs out of power at a place without the charger, the mobile phone cannot be used.

Another disadvantage with the charger is rather expensive.

A third disadvantage with the charger is exhibited when a different type of

mobile phone is used because mobile phone manufacturers follow different charger standards. A fourth disadvantage with the charger is in that the charger operates with common power voltages. If a charger does not support one of the 100V/110V and 200V/220V, it cannot be used due to the difference between a usable voltage and the type of a power supply plug.

The conventional method of charging using a cigar jack in a vehicle also has the shortcoming that charging is unavailable without the vehicle.

Therefore, there exists a need for developing a mobile phone charger for readily charging a mobile phone regardless of time and place without the problems of the conventional charging methods.

DISCLOSURE OF INVENTION

It is, therefore, an object of the present invention to provide a portable mobile phone charger that readily charges a mobile phone using a USB port of a device such as a computer.

The above object of the present invention is achieved by providing a charger for a mobile communication terminal. The charger includes a first connector for connecting to a USB port of a device, a second connector for connecting to a data communication port of the mobile communication terminal, and a voltage conversion module for converting a voltage received through the first connector to a predetermined level and outputting the converted voltage through the second connector. Therefore, a battery of the mobile communication terminal is charged with the voltage output to the second connector.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 illustrates different devices including a computer, a telephone, and a printer connected to one another via USBs;

FIG. 2 illustrates a typical USB;

FIG.3 illustrates a connection of a mobile phone with a USB port of a laptop computer according to the present invention;

FIG. 4 is a block diagram of a charger module for charging a mobile phone using a power supply line of a USB according to an embodiment of the present invention;

FIG. 5 illustrates output voltages during charging in the module shown in FIG. 4; and

FIG. 6 illustrates a connector for the mobile phone and a USB connector for a laptop computer according to the embodiment of the present invention.

Description of Important Components in the Drawings

411: voltage conversion module
412: current detection circuit
413: thermal shutdown circuit
414: error amplifier
418: FET
424: coil

BEST MODE FOR CARRYING OUT THE INVENTION

The present invention will be described hereinbelow in detail with reference to the accompanying drawings.

A description will be first made of USB. USB is the standard connection port for connecting peripherals of computers, developed by major computer-related companies including Intel, Compaq, Hewlett Packard, Microsoft, Lucent, NEC (Nippon Electric Company), Phillips, etc. USB offers a simple way to connect peripherals through an external port without opening the chassis of the system. The concurrent support of peripherals connected to a single USB port enables use of a plurality of peripheral applications such as printers, scanners, digital cameras, and speakers.

FIG. 1 illustrates an example configuration of a plurality of devices connected via USBs. In the example, a computer 111, USB hubs 112 and 113, a telephone 114, a printer 115, a camera 116, and a touch pad 117 are connected through a USB network.

USB automatically recognizes connection of a peripheral and installs it, which makes users to readily add a peripheral device by plug-and-play. That is, they can connect peripherals to one another as far as they support USB. Since USB provides port expansion through a USB hub, the USB-supporting devices can be used regardless of the number of ports.

FIG. 2 illustrates the structure of a USB cable. The USB cable includes four lines. Power is supplied to a device through a power line V_{BUS} and a ground line GND of the USB cable. V_{BUS} is +5V at a source. Data is transferred by serial transmission of differential signals D+ and D–.

According to USB 1.1 specifications, USB operates at a full speed of 12Mbps and at a low speed of 1.5Mbps. A newer version (USB version 2.0) is in the works that will raise the speed 40 times—to 480Mbps. USB 2.0 ensures backward compatibility with cables, connectors, software that operate according to USB 1.1.

Most PCs and laptop computer that have recently come to the market are provided with USB ports and the number of devices support USB ports is increasing.

FIG. 3 is a schematic view illustrating a mobile phone connected with the USB port of a laptop computer for charging the mobile phone according to the present invention. To charge a mobile phone 311, the data communication port, for example, UART (Universal Asynchronous Receiver Transmitter) port of the mobile phone 311 is connected with the USB port of a laptop computer 312 and the power line of the USB port is connected to a battery of the mobile phone 311 via the UART port. This function is performed by a USB connector, a data communication port connector, a connection cable 313 connecting the two connectors, and a voltage conversion module.

FIG. 4 illustrates a module 411 for charging the mobile phone using the power line VIN of the USB port. The USB power line of the computer is connected to the power input line VIN of the circuit and the internal charging power line of the data communication port of the mobile phone is connected to a power output line VOUT.

A first resistor 416 has an end connected to the power input line VIN at a first node 415 and the other end connected to the source of an FET 418 at a second node 417. A coil 414 has an end connected to the drain of the FET 418 and the other end connected to the power output line VOUT at a third node 419. A second resistor 420 has an end connected to the power output line VOUT at a third node 419 and the other end connected to an end of a third resistor 422 at a fourth node 421. The other end of the third resistor 422 is connected to the ground line GND at a fifth node 423. A current detection circuit 412 is connected to both ends of the first resistor 416 at the first and second nodes 415 and 417. The current detection circuit 412 is also connected to an error amplifier 414. The error amplifier 414 is connected to a thermal shutdown circuit 413. The output of the error amplifier 414 is connected to the gate of the FET 418. The inverted input of the error amplifier 414 is connected to a reference voltage, for example 1.2356V and the non-inverted input thereof, to the contact point between the second and third resistors 420 and 422, that is, the fourth node 421.

The coil 424 is charged with a voltage applied to the power input line VIN connected to the USB port of the computer via the first resistor 416, while the FET 418 is

kept on. Then, the voltage charged in the coil 424 is transferred to the output power line VOUT, charging the battery connected to the data communication port of the mobile phone. Here, a voltage (e.g., 5V) used at the USB port of the computer is converted to a voltage (e.g., 4.2V) for the battery of the mobile phone by the operations of the error amplifier 414, the coil 424, the FET 418, and the resistors.

This operation will be described in more detail referring to FIGs. 4 and 5. FIG. 5 illustrates output voltages during charging in the module shown in FIG. 4. When the FET 418 is in an on-state, a voltage input to the power input line VIN is charged in the coil 424 and then output through the power output line VOUT. The output voltage is divided by the second and third resistors 420 and 422. A divided voltage is compared with a reference voltage that functions to stably output a voltage. The error amplifier 414 controls switching of the FET 418. That is, if the divided output voltage reaches V1 shown in FIG. 5, the error amplifier 414 turns off the FET 418, thereby blocking the output of the FET 418. Therefore, the coil 424 is discharged and the output voltage drops to V2 in FIG. 5. Then, this voltage is fed back to the error amplifier 414 so that the error amplifier 414 turns on the FET 418 and the coil 424 is again charged with an input voltage. By repeating this procedure, the battery of the mobile phone is charged with the output voltage. As shown in FIG. 5, the output voltage alternates between V1 and V2 and voltages are stably provided to the battery. V1 and V2 depend on the requirement of the output voltage and the resistances of the second and third resistors 420 and 422 are determined by V1 and V2.

As stated above, both ends of the first resistor 416 are connected to the current detection circuit 412 in order to measure current flowing through the first resistor 416. Since the output current of the USB power line is limited to 500mA, the current detection circuit 412 keeps it at or below 500mA. That is, the current detection circuit 412, connected to the error amplifier 414, transmits the measurement of a current measured at both ends of the first resistor 416 to the error amplifier 414. If the output current of the USB power line is 500mA or above, the error amplifier 414, connected to the gate of the FET 418, turns off the FET 418.

In addition, a thermal shutdown circuit 413 is connected to the error amplifier 414 as shown in FIG. 4 in order to solve problems that may be generated when the above circuit operates at high temperature. If the output of the thermal shutdown circuit 413 is an overcurrent, the error amplifier 414 turns off the FET 418.

FIG. 6 illustrates a connector 611 for the data communication port of the mobile phone and a connector 612 for the USB port of the laptop computer according to the

embodiment of the present invention. The connector 611 is connected to the data communication port of the mobile phone and the connector 612, to the USB port of the laptop computer. The modules shown in FIGs. 4 can be located either at the connector 611 or at the connector 612. Also, the modules can be provided at any position between the connector 611 and the connector 612.

The present invention intends to charge a mobile communication terminal having a data communication port such as a PCS and a portable phone by connecting the mobile communication terminal to a device having a USB port such as a laptop computer, a PC, and a printer. While the present invention has been shown and described in the context of a mobile phone and a computer, it will be understood by those skilled in the art that the present invention can be implemented for other kinds of mobile communication devices and information terminals within the spirit and scope of the invention as defined by the appended claims.

INDUSTRIAL APPLICABILITY

The present invention overcomes the problems encountered with the conventional mobile phone charging methods and exhibits the following advantages. A conventional mobile phone charger is inconvenient to carry due to its bulkiness and relatively heavy weight, whereas a mobile phone charger of the present invention is easily implemented by a USB connector on one side, a data communication connector for a mobile phone, and a relatively short cable for connecting the two connectors. Therefore, the charger of the present invention is small, lightweight, and thus portable. The charger circuit can be built in the data communication port or the USB port. It is not difficult to find devices having USB ports because more and more devices support USB ports. In the case that the battery of the mobile phone runs out during work in the office, the mobile phone can be charged easily through a PC using the charger of the present invention. Another advantage with the present invention is that the charger is very cheap as compared to existing mobile phone chargers. The charger of the present invention is compatible with different kinds of mobile phone as far as they have the same type of data communication ports, whereas different chargers are required for different mobile phones in the conventional technology. A fourth advantage with the present invention is exhibited in that the charger of the present invention does not use common power voltages. If a charger supports only one of 100V/110V and 200V/220V, the charger cannot be used at the other common power voltage due to the difference between a usable voltage and the type of a power plug. The charger of the present invention overcomes this problem.

CLAIMS

1. A charger for a mobile communication terminal, comprising:

a first connector for connecting to a USB port of a device;

a second connector for connecting to a data communication port of the mobile communication terminal; and

a voltage conversion module for converting a voltage received through the first connector to a predetermined level and outputting the converted voltage through the second connector.

2. The charger of claim 1, wherein the voltage conversion module is located at one of the first and second connectors.

3. The charger of claim 1, further comprising a connection cable for connecting the first connector to the second connector.

4. The charger of any of claims 1, 2, and 3, wherein the voltage conversion module comprises:

means for temporarily charging the voltage output to the second connector;

means for switching on/off the voltage output to the second connector; and

means for controlling the operation of the switching means according to the level of the voltage output to the second connector.

5. The charger of claim 4, further comprising current detection means for providing a detection signal to the controlling means so that the controlling means turns off the switching means if the level of a current output to the second connector is a predetermined level or above.

6. The charger of claim 4, further comprising temperature detection means for providing a detection signal to the controlling means so that the controlling means turns off the switching means if the temperature of the voltage conversion module is a predetermined value or above.

7. A charger for charging a mobile communication terminal using a first terminal having a USB port, comprising:

switching means serially connected to the USB port and a data communication port of the mobile communication terminal, for switching a voltage directed from the USB port to the data communication port; and

controlling means for detecting the level f the voltage transmitted from the USB

port to the data communication port, comparing the detected voltage level with a predetermined reference voltage level, and controlling the operation of the switching means according to the comparison result.

8. The charger of claim 7, further comprising:

current detection means for detecting the level of a current flowing from the USB port to the data communication port and providing a detection signal to the controlling means so that the controlling means turns off the switching means if the current level is a predetermined level or above; and

temperature detection means for detecting the temperature of the voltage conversion module and providing a detection signal to the controlling means so that the controlling means turns off the switching means if the temperature of the voltage conversion module is a predetermined value or above.

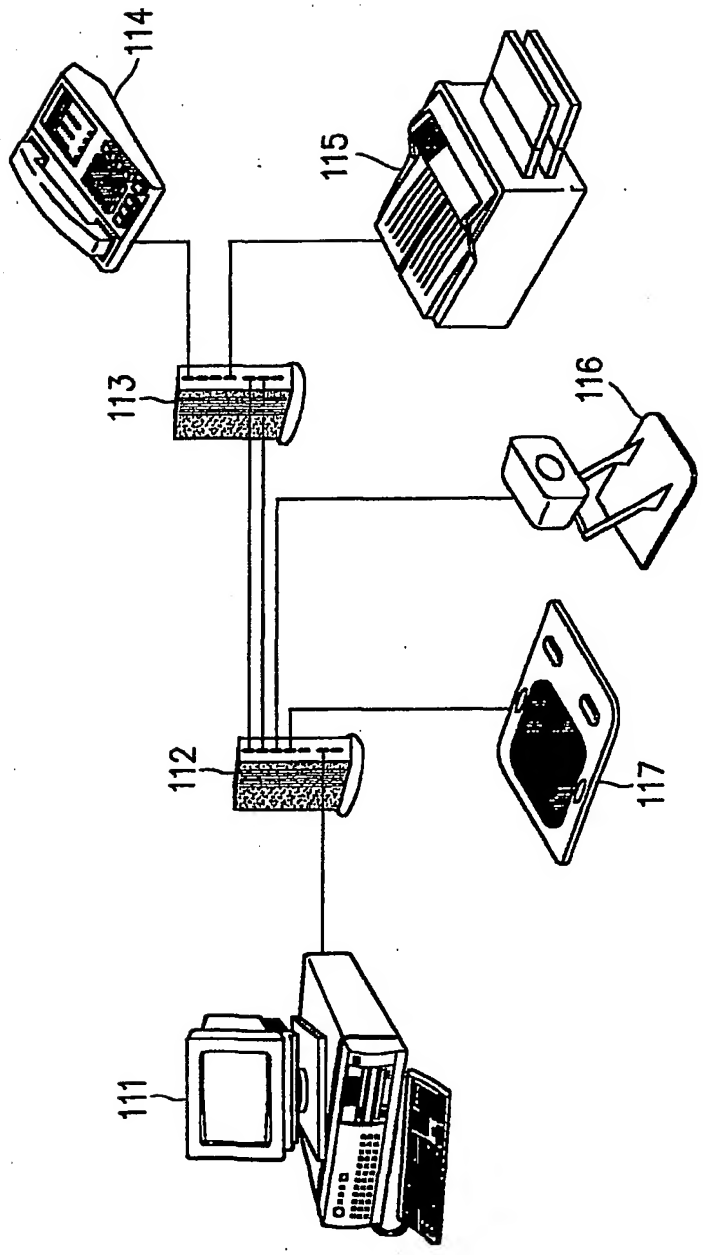

FIG. 1

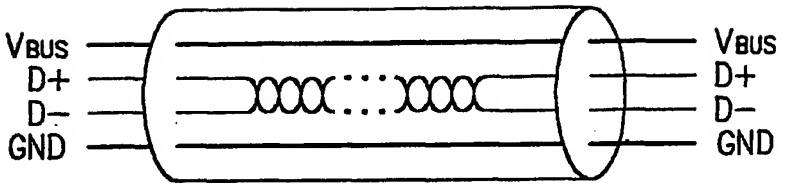

FIG. 2

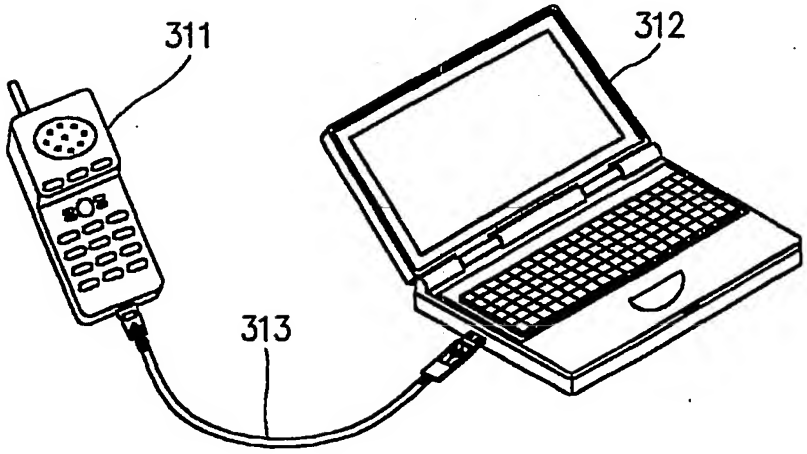

FIG. 3

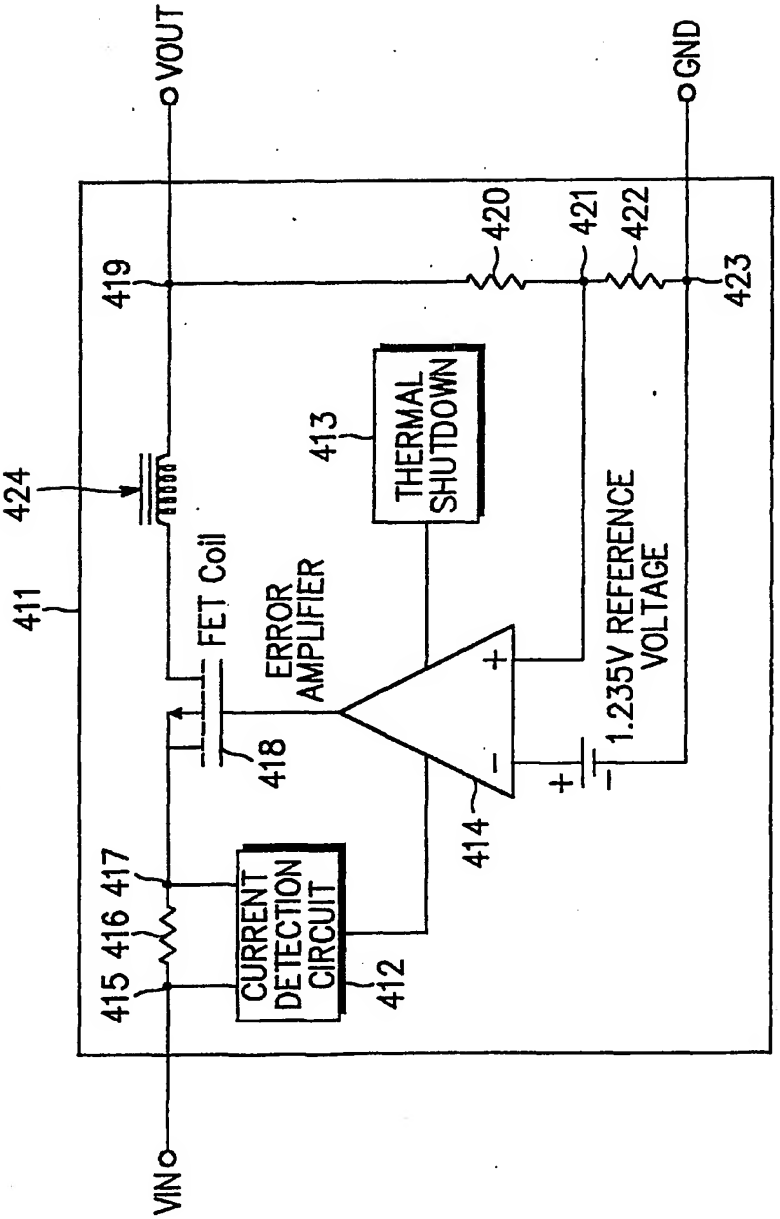
VOUT
GND
VIN
419
420
421
422
423
424
411
413
THERMAL SHUTDOWN
FET Coil
ERROR AMPLIFIER
418
414
1.235V REFERENCE VOLTAGE
415 416 417
CURRENT DETECTION CIRCUIT
412

FIG. 4

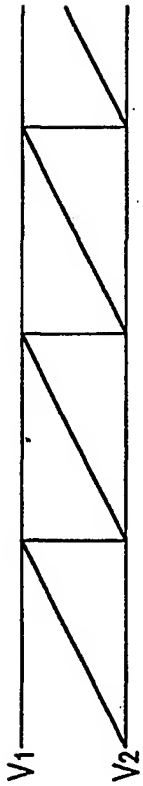

FIG. 4

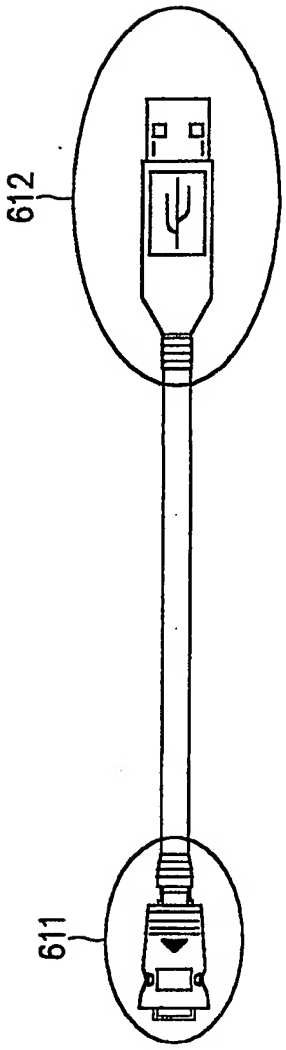

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR00/01562

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H02J 7/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)

IPC7 H02J; G05F

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search trerms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP P2000-139032A (KYOCERA CORP.) 16. 5. 2000 The eintire document	1,2,3,4,5,6,7,8
Y	US 4194147 A(Burr-Brown Research Co.) 18. 3. 1980 Fig. 1, Fig 2, Fig. 3	1,2,3,4,5,6,7,8
Y	US 5001413 A(ANT) 19. 3. 1991 Fig. 1, Fig 2	1,2,3,4,5,6,7,8

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search	Date of mailing of the international search report
17 APRIL 2001 (17.04.2001)	18 APRIL 2001 (18.04.2001)

Name and mailing address of the ISA/KR	Authorized officer
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